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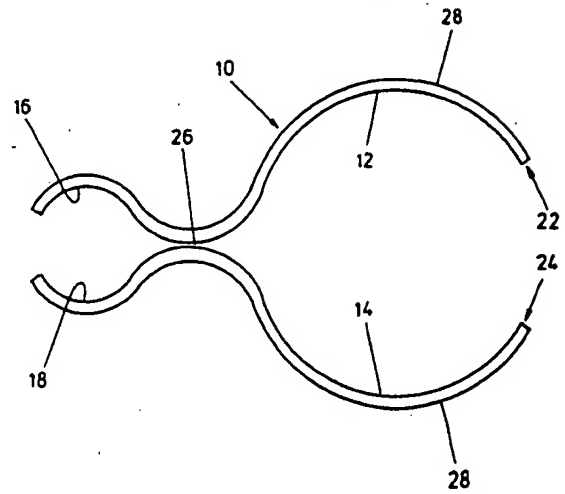
(54) Sealing gasket

(57) A gasket (10) is made of springy metal and has a transverse cross-section which is generally in the shape of an X. The cross-section has two arms (12 and 14) which project inwardly of the hole through the gasket, and two arms (16 and 18) which project outwardly of said hole. Each of the arms is adapted to resiliently engage a body to form a seal therewith around the hole. The inwardly projecting arms (12 and 14) have a different level of stiffness to the outwardly projecting arms (16 and 18), the arms with the lower level of stiffness being more widely spaced from one another than the arms with the higher level of stiffness.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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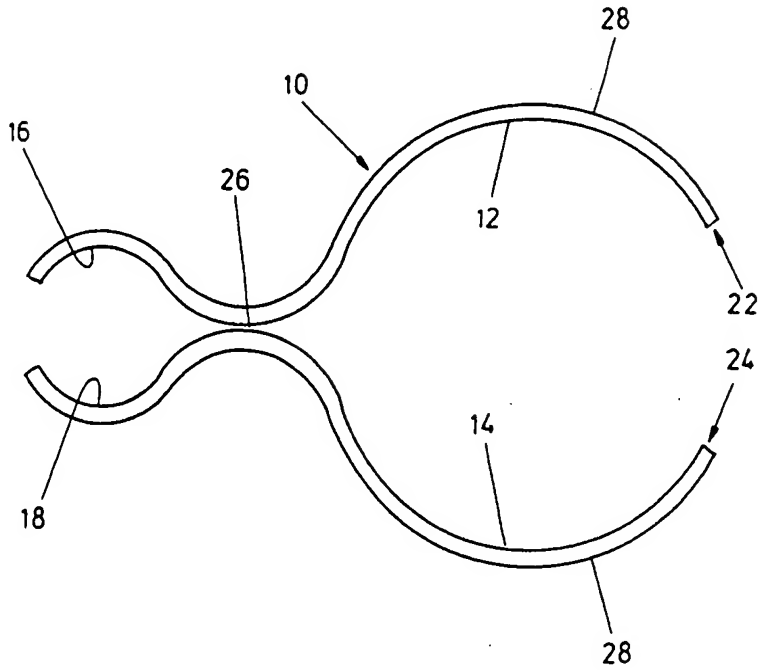

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SEALING GASKET

This invention is concerned with gaskets adapted when clamped between two bodies to seal the gap between the bodies around a chamber or passage jointly defined by the bodies. Such a gasket may be used, for example, for sealing the gap between flanges at the ends of pipes.

Gaskets require to be resilient in order to achieve a seal. In some gaskets, the resilience is achieved by using inherently resilient material such as rubber or cork and, in other gaskets, the resilience is achieved by utilising springy metal which resists being bent out of its initial shape. This invention is concerned with the latter type of gasket which comprises a sealing member which forms a closed loop extending around a hole which corresponds to the chamber or passage. Such gaskets are often in the shape of an annular ring but may have other shapes. Accordingly, the term "ring" is used herein to include a continuous band surrounding a hole of any shape.

Known gaskets made of springy metal have sealing members which have generally C or V-shaped transverse cross-sections (see US 4,877,272 for a V-shaped cross-section). The cross-section comprises two arms which project either inwardly or outwardly of the hole, the arms being adapted to each resiliently engage one of the bodies to form a seal around said hole. Since different degrees of stiffness are necessary to achieve sealing at different clamping pressures, this type of gasket can be produced with varying levels of stiffness by varying the thickness of the metal, and/or the length of the arms. However, an individual gasket of this type is only suitable for a

limited range of uses. If a gasket with a high level of stiffness is utilised for a low clamping force application, it will not flex sufficiently to produce a good seal. If, on the other hand, a gasket with a low level of stiffness is utilised for a high clamping force application, it will not withstand the force applied to it and will be unable to produce a good seal. This means that it is necessary to carefully match gaskets to their applications.

It an object of the present invention to provide a gasket which has a wider range of applications than those mentioned above.

The invention provides a gasket adapted when clamped between two bodies to seal the gap between the bodies around a chamber or passage jointly defined by the bodies, wherein the gasket forms a ring extending around a hole which corresponds to the chamber or passage, wherein the gasket is made of springy metal and has a transverse cross-section which is generally in the shape of an X, the cross-section having two arms which project inwardly of the hole through the gasket, and two arms which project outwardly of said hole, each of the arms being adapted to resiliently engage one of the bodies to form a seal therewith around the hole, and wherein the inwardly projecting arms have a different level of stiffness to the outwardly projecting arms, the arms with the lower level of stiffness being more widely spaced from one another than the arms with the higher level of stiffness.

A gasket according to the invention has two alternative levels of stiffness, one being provided by the inwardly projecting arms and the other by the outwardly projecting arms. Thus, the gasket can be utilised for a low internal pressure application involving a low clamping force when only the arms with the lower level of stiffness will be engaged by the bodies. The gasket can also be

utilised for a high internal pressure application involving a high clamping force when the arms with the lower level of stiffness will be deformed until the arms with the higher level of stiffness will be engaged. The difference in stiffness is, preferably, at least a factor of 2, and may be up to a factor of 4 or even 10.

The difference of the level of stiffness may be achieved by the inwardly projecting arms having a different length to the outwardly projecting arms. Alternatively, the inwardly projecting arms may have a different thickness or be made from a different material.

The arms may be bow-shaped to present convex surfaces to the bodies so that the line of engagement of each arm with one of the bodies is spaced from a free end of the arm. Alternatively, the arms may engage the bodies with their free ends.

The gasket may comprise two pieces of metal, one of the pieces overlying the other, each piece forming one of said inwardly projecting arms and one of said outwardly projecting arms, the two pieces being secured together by a sealing joint, eg a continuous weld, which prevents the passage of fluid between the pieces. Alternatively, the gasket may be formed by machining a ring to the required cross-section or by a combination of machining and deformation. Another possibility is to extrude a length of metal of the required cross-section, bend it into a ring, and weld its ends together.

Thin layers, eg 10 to 500 microns in thickness, of deformable material, eg expanded graphite, PTFE, or soft metal, may be adhered to the arms at least in the areas where they engage the bodies. The deformable material improves the seal by filling small cracks or fissures.

Compression limiting stops may be mounted or formed on the gasket in a central region thereof between the inward and outwardly projecting arms. Such a stop prevents the gasket from being crushed by an excessive clamping force.

There now follows a detailed description, to be read with reference to the accompanying drawing, of a gasket which is illustrative of the invention.

The drawing is a transverse cross-sectional view taken through one side of the illustrative gasket.

The illustrative gasket 10 is adapted when clamped between two bodies (not shown) to seal the gap between the bodies around a chamber or passage defined by the bodies. For example, the bodies may be flanges at the end of pipes. The gasket 10 forms a ring extending around a hole which corresponds to the chamber or passage.

The gasket 10 is made of springy metal, specifically sheet steel, and has a transverse cross-section which is generally in the shape of an X, the X being asymmetrical as will appear from the description below. The cross-section has two arms 12 and 14 which project inwardly of the hole through the gasket and two arms 16 and 18 which project outwardly of said hole. Each of the arms 12, 14, 16 and 18 is adapted to resiliently engage one of the bodies to form a seal therewith around the hole. Thus, the arms 12 and 14 are spaced from one another and, when engaged with said bodies, bend towards one another with the springiness of the metal causing a sealing force between the arm and the body. In order to move the line of engagement between each arm and its respective body away from the free end of the arm, the arms 12 and 14 bow away from one another to present convex surfaces to the bodies. The arms 16 and 18 have a similar form to the arms 12 and 14 but are much

shorter and hence are not separated by such a great distance as the arms 12 and 14.

Because the inwardly projecting arms 12 and 14 have a greater length than the outwardly projecting arms 16 and 18 they have a different level of stiffness thereto, the level being lower for the arms 12 and 14. Accordingly, it takes a greater clamping force to deflect the arms 16 and 18 than is required to deflect the arms 12 and 14. The arms 12 and 14 with the lower level of stiffness are more widely spaced from one another than the arms 16 and 18 because of their greater length.

The gasket 10 comprises two pieces of sheet steel 22 and 24, one of the pieces overlying the other. Each piece 22 and 24 forms one of the inwardly projecting arms 12 or 14 and one of the inwardly projecting arms 16 or 18. Each piece 22 and 24 can be stamped out as an annulus or can be formed from strip which is bent into an annulus and its ends joined by a weld. The pieces 22 and 24 are embossed to form the bow-shapes of the arms 12 and 16 or 14 and 18 respectively. The pieces 22 and 24 are then placed in overlying relationship and joined together by a sealing joint 26 in the form of a continuous weld. The joint 26 has to prevent leakage between the pieces 22 and 24.

The gasket 10 also comprises layers 28 of deformable material, specifically expanded graphite, which are secured, by adhesive, to the convex surfaces of the arms 12, 14, 16 and 18. The layers 28 are intended to improve sealing by filling small cracks or fissures in the bodies or the arms.

In the use of the gasket 10, as the clamping force increases between the bodies on either side of the gasket, the arms 12 and 14 engage the bodies and form a seal therewith. Engagement of the arms 12 and 14 with the

bodies occurs before the arms 16 and 18 come into engagement because the arms 12 and 14 are more widely spaced than the arms 16 and 18. In a low internal pressure and low clamping force application, the arms 12 and 14 make the seal. However, if the application has higher internal pressure and clamping force, the clamping force is increased. This causes the arms 12 and 14 to deflect further and further until the arms 16 and 18 come into engagement with the bodies. Further increase in the clamping force causes the arms 16 and 18 to apply pressure to the bodies and form a seal therewith. Thus, the gasket 10 can be utilised both in circumstances where only a low clamping force is specified, with the seal being achieved by the arms 12 and 14, and also in circumstances where a high clamping force is specified, with the seal being achieved by the arms 16 and 18. The gasket 10 also has the advantage that it will provide a seal in circumstances where a low clamping force was specified but a high clamping force is actually applied, since the sealing function can be taken over from the arms 12 and 14 by the arms 16 and 18.

CLAIMS

1 A gasket adapted when clamped between two bodies to seal the gap between the bodies around a chamber or passage jointly defined by the bodies, wherein the gasket forms a ring extending around a hole which corresponds to the chamber or passage, wherein the gasket is made of springy metal and has a transverse cross-section which is generally in the shape of an X, the cross-section having two arms which project inwardly of the hole through the gasket, and two arms which project outwardly of said hole, each of the arms being adapted to resiliently engage one of the bodies to form a seal therewith around the hole, and wherein the inwardly projecting arms have a different level of stiffness to the outwardly projecting arms, the arms with the lower level of stiffness being more widely spaced from one another than the arms with the higher level of stiffness.

2 A gasket according to claim 1, wherein the difference of the level of stiffness is achieved by the inwardly projecting arms having a different length to the outwardly projecting arms.

3 A gasket according to either one of claims 1 or 2, wherein the arms are bow-shaped so that the line of engagement of each arm with one of the bodies is spaced from a free end of the arm.

4 A gasket according to any one of claims 1 to 3, wherein the gasket comprises two pieces of metal, one of the pieces overlying the other, each piece forming one of said inwardly projecting arms and one of said

outwardly projecting arms, the two pieces being secured together by a sealing joint.

5 A gasket according to any one of claims 1 to 4, wherein the gasket also comprises layers of deformable material secured to said arms at least in the areas thereof which engage said bodies.

6 A gasket substantially as hereinbefore described with reference to, and as shown in, the accompanying drawing.

The Patent Office

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Application No: GB 9618054.2 **Examiner:** Robert L Williams
Claims searched: 1-6 **Date of search:** 28 November 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F2B (B1E)(B1D) F2G (G2A)

Int Cl (Ed.6): F16J 15/08 F16L 23/16,23/18,23/20,23/22,23/24

Other: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 1,540,465	European Atomic Energy Community	1
A	GB 0,908,044	Lockheed Aircraft Corporation	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.